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Australia

# MAPPING UNDER PRESSURE

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# MAPPING UNDER PRESSURE.

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1. Australia was largely unmapped in 1945 when the Federal and State Governments agreed to form a National Mapping Council to advise on the techniques and co-operation of mapping and mapping surveys and the development of a systematic scheme.

2. The task reported on is mainly one of surveying and mapping the undeveloped or sparsely inhabited semi-arid and desert areas in the centre and west of the continent, plus a proportion of tropical forest country in the north and north east, a total of about 2,500,000 square miles. In these areas there is usually some time of the year suitable for air photography.

3. Within the space available it is possible to deal only with survey and compilation techniques. Map production follows modern procedures.

4. The immediate demand has been for:
(a) large and medium scale contoured maps required for specific developmental projects,
(b) a general national coverage of maps required for defence and administration purposes and for resources surveys and general developmental planning.

5. Large and medium scale mapping has been very extensive throughout the world; but there is urgent need of the second type in the undeveloped countries and for this the Australian approach and method should be of value.

## BASIC PRINCIPLES AND PROCEDURES

6. Certain basic principles have always been borne in mind:
(a) the most desirable form of presentation of topographic data is a full contoured topographic map.
(b) All such maps must fit together into one homogenous pattern over the whole country and so must be based on a national geodetic survey.
(c) Topographic data for any purpose should promptly provide as much information as possible.
(d) A very large number of map users can make use of planimetric maps with an indication of relief and do not require portrayal of relief in measurable form.
(e) There is always a continuing need for map revision.
(f) A continuing improvement can be expected in surveying and mapping

equipment and techniques.
(g) For greater efficiency large areas should be tackled instead of small isolated priority areas.
(h) If work is organized in successive stages: air photographs, uncontrolled photomaps, planimetric maps and contoured maps, instead of attempting production of fully contoured topographic maps, then: (i) the final overall contoured maps will be produced in much the same time; (ii) earlier provision of topographic information is possible in respect of the whole country; (iii) this can be used in resources surveys and developmental planning and in planning subsequent geodetic and topographic surveys; (iv) progressive "on the job" training of staff is possible; and (v) the latest technical developments become available at the more complicated stages of the work.

8. Consideration of these principles has led to adoption of the following procedures:
(a) an assessment and timely review of the overall basic national requirement for fully contoured maps and the continuous consideration of this requirement as a background to the more expedient mapping activities;
(b) agreement on the basic plan of National Geodetic Survey necessary for the ultimate topographic mapping requirement;
(c) the provision of an early nation-wide coverage of air photographs;
(d) the preparation and distribution of uncontrolled photomaps as soon as photography is available;
(e) a phased programme of mapping aimed at: (i) the complete coverage of Australia with 1:250,000 scale maps; the first edition of which will be a planimetric series; the second edition of which will be a fully contoured edition with the early planimetric detail revised to the date of re-compilation and adjusted to fit to the National Geodetic Survey; (ii) subsequent production of 1:100,000 scale fully contoured mapping of areas of special developmental interest; and (iii) the early commencement of geodetic survey and so arranging this that requisite control data is available in advance of the later phases.

## CONTROL SURVEYS

9. Horizontal Control. Initially a large number of astro fixes were observed by small mobile parties using second order theodolites and aural time reception techniques. This programme should terminate during 1962.

10. The provision of horizontal geodetic control is currently proceeding apace on the basis of first order Tellurometer traverses controlled for azimuth by frequent Laplace observations. It is hoped to organize, by the end of 1965, a major network of traverses so that no point in the remoter areas is more than 100-150 miles from a first order station and no more that 50-100 miles from such a station in the more settled areas.

11. For the "second edition" it is planned to extend horizontal control by, depending on circumstances, either the aid of airborne "Aerodist" equipment or rapid second order Tellurometer traverses supported by helicopter transportation; with the object of providing a suitable grid pattern that will control subsequent "block adjustment" by photogrammetric methods; a procedure to be well established by the beginning of 1966.

12. Vertical Control. Some precision levelling is being undertaken but it is planned to cover the country in the first instance with a basic network of third order levelling which should provide ample accuracy for subsequent operations.

13. In the course of Tellurometer traversing vertical angles are observed. Resultant calculated heights have a standard deviation of ± 3 feet.

14. In the planimetric mapping phase an attempt is made to get enough spot elevations to allow of approximate contouring for the I.C.A.O., 1:1,000,000 series.

15. When obtaining astro fix control and in the course of identification surveys, field parties carry out long range barometric heighting using aircraft type altimeters grouped in portable batteries and working within the national meteorological net work of fixed mercury barometers. The results of this work are considered to have a standard deviation of ± 50 feet.

16. The elevations of some hill tops are determined barometrically with the aid of helicopters while others are established from the mean of several altimeter readings taken in the course of close passes by light aircraft. These latter probably have a standard deviation of ± 200 feet.

17. In preparation for the second (contoured) edition more accurate barometric heighting is under way, a considerable amount of this work having been aided by helicopters working between level lines about 50 to 100 miles apart and the resultant elevations appear to have a standard deviation of ± 10 feet.

18. An Automatic Radar Profile Recorder is being used experimentally.

## PHOTOGRAMMETRIC SURVEYS

19. Air Photography and Photomaps. Air photography, which now covers almost all Australia, has, in conjunction with photomaps, been useful in exploring unmapped areas, and probably a major factor in the spectacular discoveries of mineral resources in recent years.

20. The demands of resources investigators for large scale photographs have been resisted and most initial photography has been taken at altitudes of about 25,000 feet.

21. In the early stages, six inch, wide angle lens cameras were used to give a considerable coverage of 1:50,000 scale photography but in recent years three and half inch super wide angle lens cameras have been used very satisfactorily to provide 1:84,000 scale photography.

22. Photography for Federal Governmental agencies is contracted out to commercial air survey firms. Where subsequent 1:100,000 and possibly 1:50,000 mapping is intended, re-photography is likely to be arranged using the super wide angle camera and simultaneous Radar profiling from a height of 25,000 feet.

23. Photogrammetric Compilations. At present, slotted templates are used in conjunction with astro fixes, or astro fixes combined with geodetic survey, to give planimetric control positions. In the early stages requests for special priority areas had to be met, unavoidably. Efficiency is obtained by assembling large areas at the one time.

24. With wide angle photography detail is filled in with the aid of "sketchmasters" but with super wide angle photography in other

than flattish country the "Stereotope" is used for planimetric plotting.

25. Original compilation sheets are prepared at near photo scale and advance copies are supplied to resources investigators for plotting of their data direct from photographs.

26. It is considered that quite an amount of useful contouring for scales of 1:100,000 and smaller will ultimately be done with the simpler type of stereo plotter. However, it is hoped that by the time contouring starts in earnest, electronically controlled contour plotters will be well established.

27. Field Checking and Current Revision. When compilation is completed a field identification survey is carried out from a light aircraft fitted with a small air survey camera. Anything to be added to the compilation is photographed, matched to the basic photography and then plotted on the compilation.

## OUTPUT

28. Geodetic Survey. Rates for Tellurometer traversing have varied from 30 to 100 miles per man/year depending on transportation and terrain difficulties. On the average about 5 Laplace stations are completed per man/year.

29. Photogrammetric Survey. Rates have improved from about 3,000 square miles compiled per man/year to 4,000 square miles per man/year. Future use of super wide angle photography should lift this output to about 6,000 square miles per man/year. The ratio of field to office staff is about 1 to 2.

30. If a start were now being made on mapping Australia much the same practices would be followed but air photographs would be taken by cameras equipped with the super wide angle lens; radar profiles would be made simultaneously with this photography; initial astro fix control would be limited to a wide grid net work and templates would be assembled on the basis of a "Jerie" technique modified to suit graphical adjustment.

31. The same practices would be adopted for early production of photomaps and the phasing of geodetic control surveys and planimetric compilation to be brought to such a stage of completion as to permit of a smooth flow into the final phase of contoured mapping. At that stage, it is hoped, electronically controlled contouring equipment will be available.

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